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EXAMINER	
LEUNG, CHRISTINA Y	
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Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No.	Applicant(s)	
	09/827,454	RUGGIERO, ANTHONY J.	
	Examiner	Art Unit	
	Christina Y. Leung	2633	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 August 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-49* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-49* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 21 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

3. Claim 21 recites the limitation "wherein the aperture is greater than 10 microns" in lines 1-2 of the claim. There is insufficient antecedent basis for this limitation in the claim. Claim 18, on which it depends, previously recited "an aperture" is located in the tope electrode, but Examiner notes that claim 18 no longer recites an aperture.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1-7, 9-14, 16, 17, 40, 41, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akkapeddi (US 4,949,056 A) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics Letters, July 1997) and Pepper et al. (US 5,038,359 A).

Regarding claim 1, Akkapeddi disclose a system (Figure 1) comprising:

a transceiver 10 constructed to transmit an interrogating beam; and

a communication station capable of receiving the interrogating beam.

Akkapeddi further disclose that the communication station includes a phase conjugator but does not specifically disclose that the communication station includes a plurality of broad area intra-cavity phase conjugators arranged in an array.

Vasil'ev et al. teaches a broad area, intra-cavity phase conjugator (Figures 1a and 1b; columns 1-3) which may be used in a system to produce a phase conjugate beam such as in the system disclosed by Akkapeddi.

Pepper et al. (Figures 9-10; column 10, lines 47-68; column 11, lines 1-17) teach another type of phase conjugator, but also further suggests that phase conjugators may be arranged in an array.

It would have been obvious to use the intra-cavity phase conjugator taught by Vasil'ev et al. in the system disclosed by Akkapeddi as a way to provide a phase conjugate light beam without requiring a separate source of pump light, and to further arrange the phase conjugators in an array as taught by Pepper et al. to provide a broader area for producing phase conjugation. Again, Akkapeddi already generally discloses a communication station which receives an interrogating beam and which includes a phase conjugator.

Regarding claim 2, Akkapeddi discloses that the communication station is capable of transmitting an encoded phase conjugate beam to the transceiver from the phase conjugator (using encoder 26). The phase conjugators taught by Vasil'ev et al. and Pepper et al., in the system suggested by the combination of the three references, would also be capable of transmitting an encoded phase conjugate beam from the system.

Regarding claim 3, Akkapeddi discloses that communication station is configured to respond to the interrogating beam by encoding data into a phase conjugate beam (using encoder 26) and the phase conjugator taught by Vasil'ev et al. pumps the encoded phase conjugate beam by intra-cavity nondegenerate four wave mixing (Abstract).

Regarding claims 4-5, Akkapeddi does not specifically disclose that the encoding of the phase conjugate beam is accomplished at rates exceeding approximately 1 kHz or in the range of approximately 1 Ghz to approximately 10 GHz.. However, Vasil'ev et al. specifically teach a phase conjugator with a "subnanosecond response" (column 1, paragraph 1), which would be understood in the art as corresponding to a rate in the range of above 1 Ghz. Also, Pepper et al. teach that a phase conjugate beam may be encoded at rates including 10 GHz (column 8, lines 32-50). It would have been obvious to a person of ordinary skill in the art to encode the phase conjugate beam as disclosed by Akkapeddi at rates suggested by or Vasil'ev et al. Pepper et al. as an engineering design choice of an efficient response rate for encoding the beam.

Regarding claim 6, Pepper et al. (Figure 9, elements 148-150) that the plurality of phase conjugators may be arranged in a substantially linear array. Regarding claim 7, Pepper et al. teach that the plurality of phase conjugators may be substantially spaced apart (Figure 9). Regarding claim 9, Pepper et al. teach that that plurality of phase conjugators may be any practical number (column 11, lines 14-17). Regarding claims 6, 7, and 9, it would have been obvious to a person of ordinary skill in the art to use an array of phase conjugators in a configuration as suggested by Pepper et al. in the system disclosed by Akkapeddi in view of Vasil'ev et al. as an engineering design choice of a way to arrange the phase conjugators. The claimed differences exist not as a result of an attempt by Applicants to solve an unknown

problem but merely amount to the selection of expedients known as design choices to one of ordinary skill in the art.

Regarding claim 10, the broad area intra-cavity phase conjugator taught by Vasil'ev et al. comprises an aperture sufficient to resolve a substantial portion of the spatial components of the input wavefront of the interrogating beam.

Regarding claim 11, Vasil'ev et al. do not specifically teach that the intra-cavity phase conjugator comprises an aperture sufficient to resolve greater than approximately 80% of the spatial components of the input wavefront of the interrogating beam, but teaches that it is able to generally resolve a substantial portion of the input wavefront of the interrogating beam. It would have been obvious to a person of ordinary skill in the art to specifically ensure that the aperture is sufficient to resolve greater than 80% of the spatial components of the input wavefront of the interrogating beam in the system disclosed by Akkapeddi in view of Vasil'ev et al. and Pepper et al. simply in order to ensure that the input wavefront is sufficiently resolved.

Regarding claim 13, the intra-cavity phase conjugator taught by Vasil'ev et al. includes a top electrode with an aperture (column 2, which teaches an upper metal contact, or a "top electrode" and also teaches the dimensions of an aperture). Again, it would have been obvious to use the intra-cavity phase conjugator taught by Vasil'ev et al. in the system disclosed by Akkapeddi as a way to provide a phase conjugate light beam without requiring a separate source of pump light.

Regarding claim 12, Akkapeddi discloses that the communication station does not have a movable part point and tracking system (column 1, lines 28-63; column 2, lines 15-44).

Regarding claim 14, Akkapeddi discloses that the interrogating beam may interact with pump beam operating in the phase conjugator at a substantially transverse angle (Figure 2).

Regarding claim 16, Akkapeddi discloses that the transceiver may be mounted on a satellite (Figure 1).

Regarding claim 17, Akkapeddi discloses that the communication station may be mounted on a ground station.

Regarding claim 45, Pepper et al. does not specifically teach that the phase conjugators may be arrange in a two dimensional array, but they do teach that the phase conjugators may be one of a plurality of phase conjugators arranged in an array of phase conjugators (Figures 9 and 10). They do not specifically disclose that this array may be a two dimensional array, but it would have been obvious to a person of ordinary skill in the art to include a plurality of arrays of phase conjugators in the system described by Akkapeddi in view of Vasil'ev et al. and Pepper et al. as an engineering design choice of a way to arrange the phase conjugators especially since Pepper et al. teach that any number of phase conjugators may be included (column 11, lines 14-17).

Regarding claim 40, Akkapeddi discloses a method (Figures 1 and 2) comprising:

transmitting an interrogating beam from a transceiver;

receiving the interrogating beam at an phase conjugator through apertures located in the top of the phase conjugator;

modulating data onto a phase conjugate beam; and

transmitting the phase conjugate beam to the transceiver.

Akkapeddi does not disclose an array of broad area intra-cavity phase conjugators. As similarly discussed above with regard to claim 1, Vasil'ev et al. teach a broad area intra-cavity conjugator for producing a phase conjugate beam as in the system disclosed by Akkapeddi. The phase conjugator taught by Vasil'ev et al. further includes a top electrode with an aperture (column 2). Pepper et al. (Figures 9-10; column 10, lines 47-68; column 11, lines 1-17) teach another type of phase conjugator, but also further suggests that phase conjugators may be arranged in an array. It would have been obvious to use the broad area intra-cavity phase conjugator taught by Vasil'ev et al. in the system disclosed by Akkapeddi as a way to provide a phase conjugate light beam without requiring a separate source of pump light, and to further arrange the phase conjugators in an array as taught by Pepper et al. to provide a broader area for producing phase conjugation.

Regarding claim 41, Akkapeddi disclose a method (Figures 1 and 2) comprising:

transmitting an interrogating beam from a transceiver;

receiving the interrogating beam at a phase conjugator and resolving a substantial portion of the spatial components of the input wavefront of the interrogating beam;

modulating data onto a phase conjugate beam; and

transmitting the phase conjugate beam to the transceiver.

Again, Akkapeddi does not disclose an array of broad area intra-cavity phase conjugators. However, Vasil'ev et al. teach a broad area intra-cavity conjugator. Pepper et al. (Figures 9-10; column 10, lines 47-68; column 11, lines 1-17) teach that a plurality of phase conjugators arranged in an array may be used in a system to produce a phase conjugate beam as in the method disclosed by Akkapeddi. It would have been obvious to use the broad area intra-cavity

phase conjugator taught by Vasil'ev et al. in the system disclosed by Akkapeddi as a way to provide a phase conjugate light beam without requiring a separate source of pump light, and to further arrange the phase conjugators in an array as taught by Pepper et al. to provide a broader area for producing phase conjugation.

6. Claims 8 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akkapeddi in view of Vasil'ev et al. and Pepper et al. as applied to claim 1 above, and further in view of Watanabe (US 5,920,588 A).

Regarding claim 8, the phase conjugator taught by Vasil'ev et al. is not specifically as single gain stripe device, but Watanabe teaches an intracavity phase conjugator comprising a single gain stripe device (column 16, lines 43-67; column 17, lines 1-3). It would have been obvious to a person of ordinary skill in the art to use a single gain stripe device as taught by Watanabe in the system described by Akkapeddi in view of Vasil'ev et al. and Pepper et al. as an engineering design choice of a nonlinear medium for producing the phase conjugate beam already disclosed.

Regarding claim 15, Akkapeddi does not teach that the interrogating beam may interact with pump beams operating in the plurality of phase conjugators in a substantially parallel manner, but Vasil'ev et al. teach that the interrogating beam may interact with the pump beams in a substantially parallel manner (Figure 1b), and Watanabe also teaches an intracavity phase conjugator wherein an interrogating beam may interact with pump beams in a substantially parallel manner (Figure 2). It would have been obvious to a person of ordinary skill in the art to arrange the interrogating beam and pump beams as suggested by Vasil'ev et al. and Watanabe et

al. in the system described by Akkapeddi in view of Vasil'ev et al. and Pepper et al. as an engineering design choice of an arrangement for the various elements.

7. Claims 18, 19, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akkapeddi in view of Vasil'ev et al.

Regarding claim 18, as similarly discussed with regard to claim 1, Akkapeddi discloses a system (Figures 1 and 2) comprising:

a transceiver 10 constructed to transmit an interrogating beam;

a communication station capable of receiving the interrogating beam; and

the communication station having an phase conjugator 12.

Akkapeddi does not specifically disclose that the phase conjugator is a broad area intra-cavity phase conjugator including a top electrode. However, as similarly discussed above with regard to claim 1, Vasil'ev et al. teach a broad area intra-cavity phase conjugator for producing a phase conjugate beam as in the system disclosed by Akkapeddi. Vasil'ev et al. further teach an upper metal contact, or a "top electrode," for applying current to the device (column 2).

Regarding claim 18, it would have been obvious to use the intra-cavity phase conjugator taught by Vasil'ev et al. in the system disclosed by Akkapeddi as a way to provide a phase conjugate light beam without requiring a separate source of pump light.

Regarding claim 19, Akkapeddi discloses that the interrogating beam may interact with at least one pump beam operating in the phase conjugator at a substantially transverse angle (Figure 2).

Regarding claim 21, as well as it may be understood with regard to 35 U.S.C. 112 discussed above, Vasil'ev et al. do not specifically teach that the aperture is greater than 10

microns, but it would have been obvious to a person of ordinary skill in the art to specify that the aperture in system described by Akkapeddi in view of Vasil'ev et al. be greater than 10 microns as an engineering design choice of a way to allow sufficient light into the phase conjugator.

8. Claims 20 and 46-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akkapeddi in view of Vasil'ev et al. and Pepper et al. as applied to claim 1 above or Akkapeddi in view of Vasil'ev et al. as applied to claim 18 above, and further in view of Watanabe.

Regarding claims 46 and 47, Akkapeddi in view of Vasil'ev et al. and Pepper et al. describe a system as discussed above with regard to claim 1. Regarding claim 46, Vasil'ev et al. further teach that the phase conjugator includes a nonlinear medium adapted to produce at least two coherent pump beams (Figure 1b) but do not specifically teach a means to encode the coherent pump beams. Watanabe teaches a means to encode the pump beams (Figure 16, modulating circuit 74). Regarding claim 47 in particular, Vasil'ev et al. teach that the nonlinear medium is a laser diode structure but not specifically a distributed feedback laser device. However, Watanabe teaches that the nonlinear medium may be a diode structure comprising a distributed feedback laser device. It would have been obvious to use the distributed feedback laser device taught by Watanabe in the system described by Akkapeddi in view of Vasil'ev et al. and Pepper et al. as an engineering design choice of a nonlinear medium for producing phase conjugation. It would also have obvious to a person of ordinary skill in the art to provide a means to encode the pump beams as taught by Watanabe in the system described by Akkapeddi in view of Vasil'ev et al. and Pepper et al. in order to modulate the beams with information for transmission in the communications system.

Regarding claims 20, 48, and 49, Akkapeddi in view of Vasil'ev et al. describe a system as discussed above with regard to claim 18.

Regarding claim 48, Vasil'ev et al. teach that the phase conjugator includes a nonlinear medium adapted to produce at least two coherent pump beams (Figure 1b) but do not specifically teach a means to encode the coherent pump beams. Again, Watanabe teaches a means to encode the pump beams (Figure 16, modulating circuit 74). It would also have obvious to a person of ordinary skill in the art to provide a means to encode the pump beams as taught by Watanabe in the system described by Akkapeddi in view of Vasil'ev et al. in order to modulate the beams with information for transmission in the communications system.

Regarding claims 20 and 49,Vasil'ev et al. further teach that the phase conjugator may comprise a broad-area laser device (Abstract) but do not specifically teach a distributed feedback laser device. Again, Watanabe teaches that the nonlinear medium may be a diode structure comprising a distributed feedback laser device. It would have been obvious to use the distributed feedback laser device taught by Watanabe in the system described by Akkapeddi in view of Vasil'ev et al. as an engineering design choice of a nonlinear medium for producing phase conjugation.

9. Claims 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akkapeddi et al. in view of Vasil'ev et al. and Damen et al. (US 5,675,436 A)

Regarding claim 22, Akkapeddi et al. (Figures 1 and 2) disclose a system comprising:

a transceiver constructed to transmit an interrogating beam;

a communication station capable of receiving the interrogating beam; and

the communication station having an phase conjugator.

Akkapeddi et al. do not specifically disclose that the phase conjugator may be a broad area intra-cavity phase conjugator which is a VCSEL structure. However, as similarly discussed above with regard to claim 1, Vasil'ev et al. teach a broad area intra-cavity phase conjugator.

Vasil'ev et al. further teach that the phase conjugator may be a semiconductor laser diode but does not specifically teach that it may by a VCSEL structure. Damen et al. (column 3, lines 37-61) teach that a VCSEL structure may be used to provide a nonlinear element for four wave mixing such as the laser device taught by Vasil'ev et al. Regarding claim 23 in particular, Vasil'ev et al. further teach that the interrogating beam interacts with at least one pump beam in a substantially parallel manner (Figure 1b). It would have been obvious to use the broad area intra-cavity phase conjugator which is a VCSEL structure taught by Vasil'ev et al. and Damen et al. in the system disclosed by Akkapeddi as a way to provide a phase conjugate light beam without requiring a separate source of pump light.

10. Claims 24, 26-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe in view of Vasil'ev et al. and MacDonald (US 5,519,723 A).

Regarding claim 24, Watanabe discloses an optical interconnection system (Figure 2) comprising:

a fiber optic device (fiber 2) constructed to transmit an interrogating beam (ωs) to a predetermined intra-cavity phase conjugator 1.

Although Watanabe discloses transmitting the interrogating beam through a fiber, Watanabe does not specifically disclose a transmitting device which creates the beam. However, it is well known in the art that laser beams such as disclosed by Watanabe may be created by

transmitters, and it would have been obvious to a person of ordinary skill in the art to include a transmitter in order to provide the interrogating beam.

Watanabe does not specifically disclose a micro-mirror. However, it is well known in the art that mirrors and other reflectors may be used to steer light beams as desired among elements in an optical system. MacDonald in particular teaches using mirrors to steer light into a nonlinear medium for phase conjugation (Figure 1). It would have been obvious to a person of ordinary skill in the art to use a mirror as taught by MacDonald in the system disclosed by Watanabe in order to steer the interrogating beam in whatever direction required by the placement of elements in the system.

Watanabe also does not specifically disclose that the phase conjugator may be a broad area phase conjugator, but Vasil'ev et al. teach a broad area intracavity phase conjugator. It would have been obvious to a person of ordinary skill in the art to use the broad area phase conjugator taught by Vasil'ev et al. as the phase conjugator in the system suggested by Watanabe in view of MacDonald as an engineering design choice of a phase conjugating medium.

Regarding claim 26, Watanabe discloses that the interrogating beam may interact with at least one pump beam operating in the phase conjugator in a substantially parallel manner (Figure 2).

Regarding claims 27 and 33, Watanabe further discloses that the phase conjugator may include a top electrode with an aperture (Figure 2), and the phase conjugator taught by Vasil'ev et al. also includes a top electrode and an aperture (column 2) .

Regarding claim 28, Watanabe discloses that the phase conjugator may comprise a distributed feedback laser device (Figure 2; column 16, column 23-67; column 17, lines 1-3).

Regarding claim 29, Watanabe does not specifically disclose that the interrogating beam interacts with the at least one pump beam at a transverse angle. However, MacDonald teaches that an interrogating beam may interact with a pump beam in a phase conjugator such as disclosed by Watanabe at a transverse angle. It would have been obvious to a person of ordinary skill in the art to use an angle such as taught by MacDonald in the system described by Watanabe in view of MacDonald in order to accommodate the position of the elements in relation to each other.

Regarding claim 30, Watanabe discloses that the predetermined phase conjugator may be one of a plurality of phase conjugators arranged in an array (Figure 21). Regarding claim 31, Watanabe does not specifically disclose that this array may be a first array of a plurality of arrays, but it would have been obvious to a person of ordinary skill in the art to include a plurality of arrays of phase conjugators in the system disclosed by Watanabe as an engineering design choice of a way to arrange the phase conjugators to accommodate however many separate signals needed in the system.

Regarding claim 32, Watanabe discloses that the phase conjugator may comprise a single gain stripe device (column 16, lines 43-67; column 17, lines 1-3).

11. Claim 25 is rejected under 35 U.S.C. 103 as being anticipated by Watanabe et al. in view of Vasil'ev et al. and MacDonald as applied to claim 24 above, and further in view of Damen et al.

Regarding claim 25, Watanabe in view of Vasil'ev et al. discloses that the phase conjugator may comprise a broad-area, distributed feedback laser device as discussed above, but they do not specifically teach that it may by a VCSEL structure. Damen et al. (column 3, lines

37-61) teach that a VCSEL structure may be used to provide a nonlinear element for four wave mixing such as the laser device taught by Watanabe in view of Vasil'ev et al. It would have been obvious to use a phase conjugator which is a VCSEL structure as taught by Damen et al. in the system disclosed by Watanabe in view of Vasil'ev et al. and MacDonald as an engineering design choice of a phase conjugating medium.

12. Claims 34 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sharp et al. (US 5,317,442 A) in view of Vasil'ev et al.

Regarding claim 34, Sharp et al. disclose a system (Figures 2 and 5) comprising:

a means 23 for transmitting and receiving an interrogating beam;

a communication station 50 operatively coupled to the transmitting and receiving means wherein the station includes a means 20 for returning a phase conjugate beam to the transmitting and receiving means (column 2, lines 26-42).

Sharp et al. do not specifically disclose that the means for returning a phase conjugate beam is a broad area intracavity phase conjugator, but Vasil'ev et al. teach a broad area intracavity device for returning a phase conjugate beam such as disclosed by Sharp et al. It would have been obvious to a person of ordinary skill in the art to use the broad area intracavity phase conjugator taught by Vasil'ev et al. in the system disclosed by Sharp et al. as an engineering design choice of a way to provide a phase conjugate beam without requiring a separate source of pump light.

Regarding claim 35, Sharp et al. disclose a method (Figures 2 and 5) comprising:

transmitting an interrogating beam from a transceiver 52;

receiving the interrogating beam at a communication station 50;

encoding data (with modulator 29) onto a phase conjugate beam; and

transmitting the encoded phase conjugate beam back to the transceiver (column 2, lines 26-42).

Sharp et al. do not specifically disclose producing the phase conjugate beam with a broad area intracavity phase conjugator or pumping the encoded phase conjugate reflectivity by nondegenerate four wave mixing. However, Vasil'ev et al. teach a broad area intracavity phase conjugator and teach that four wave mixing is a known way of producing phase conjugate beams such as disclosed by Sharp et al. (Abstract). It would have been obvious to a person of ordinary skill in the art to specifically use a broad area intracavity phase conjugator and four wave mixing as Vasil'ev et al. teach in the method disclosed by Sharp et al. as a known engineering design choice of a way to produce the phase conjugate beam.

13. Claims 36-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sharp et al. in view of Pepper et al. and Vasil'ev et al.

Regarding claim 36, Sharp et al. disclose a method (Figures 2 and 5) comprising:

transmitting an interrogating beam from a transceiver 52;

receiving the interrogating beam at a phase conjugator;

modulating data onto a phase conjugate beam (with modulator 29); and

transmitting the phase conjugate beam to the transceiver.

Sharp et al. does not specifically disclose an array of phase conjugators. However, Pepper et al. (Figures 9-10; column 10, lines 47-68; column 11, lines 1-17) teach that a plurality of phase conjugators arranged in an array may be used in a system to produce a phase conjugate beam as in the method disclosed by Sharp et al. It would have been obvious to a person of ordinary skill

in the art to use a plurality of phase conjugators arranged in an array as taught by Pepper et al. in the method disclosed by Sharp et al. in order to provide a broader area to produce phase conjugation.

Again, Sharp et al. do not specifically disclose producing the phase conjugate beam with a broad area intracavity phase conjugator, but Vasil'ev et al. teach a broad area intracavity phase conjugator for producing phase conjugate beams such as disclosed by Sharp et al. (Abstract). It would have been obvious to a person of ordinary skill in the art to specifically use a broad area intracavity phase conjugator as Vasil'ev et al. teach in the method disclosed by Sharp et al. as a known engineering design choice of a way to produce the phase conjugate beam.

Regarding claim 37, Sharp et al. disclose that their method may further comprise collecting data through a sensor 24 located in proximity to the phase conjugator and transmitting the data to the phase conjugator (modulator 29).

Regarding claim 38, Sharp does not specifically disclose that the interrogating beam interacts with at least one pump beam operating in each of the phase conjugators in a substantially parallel manner. However, Pepper et al. teach that the interrogating beam may interact with pump beams operating in the plurality of phase conjugators in a substantially parallel manner (Figure 8). It would have been obvious to a person of ordinary skill in the art to arrange the interrogating beam and pump beams as suggested by Pepper et al. in the method disclosed by Sharp et al. as an engineering design choice of the most convenient angle.

Regarding claim 39, Sharp et al. discloses that the interrogating beam interacts with at least one pump beam operating in the phase conjugator in a substantially transverse manner (Figure 2).

14. Claims 42-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pepper et al. in view of Vasil'ev et al.

Regarding claim 42, Pepper et al. disclose a method of providing an optical interconnect comprising:

transmitting an interrogating beam from a fiber optic device;

receiving the interrogating beam at a micro-mirror 16 across free space;

transmitting a second beam from the micro-mirror; and

producing a phase conjugate beam or the second beam received from the micro-mirror by a predetermined phase conjugator 12.

Pepper et al. do not specifically disclose a broad area intracavity phase conjugator, but Vasil'ev et al. teach a broad area intracavity phase conjugator. It would have been obvious to a person of ordinary skill in the art to use the phase conjugator taught by Vasil'ev et al. as the phase conjugator in the system disclosed by Pepper et al. as an engineering design choice of a phase conjugating means which does not require a separate source of pump light.

Regarding claim 43, Pepper et al. disclose (Figures 6-10) that the method may further include modulating data onto the second beam at said predetermined phase conjugator (with modulator 62);

transmitting an encoded phase conjugated beam to the micro-mirror 16.

Regarding claim 44, Pepper et al. disclose that the method may further include transmitting a third beam from the micro-mirror to the fiber optic device (Figures 6-10).

Response to Arguments

15. Applicant's arguments with respect to claims 1-49 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christina Y. Leung whose telephone number is 703-605-1186. The examiner can normally be reached on Monday to Friday, 6:30 to 3:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan can be reached on 703-305-4729. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9314.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-4700.

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